

RARE AND ENDANGERED AQUATIC VASCULAR PLANTS OF OHIO: AN ANNOTATED LIST OF THE IMPERILED SPECIES

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In Ohio and elsewhere, considerable concern is growing for the identity and protection of rare and endangered, or imperiled, species of plants. Man's impact on the environment has caused drastic changes that are now affecting organisms to the extent that these imperiled species are extinct or becoming extirpated, or their survival is endangered or threatened. Lists of rare and endangered species of plants for various states are now beginning to appear, for example, Arkansas (Tucker, 1974), Missouri (Holt, Keefe, Lewis, Pflieger, and Sullivan, 1974), New Jersey (Fairbrothers and Hough, 1973), and Texas (Anonymous, 1974), and a national report on the endangered and threatened plant species of the United States recently has been presented to the Congress of the United States (Ayensu and others, 1974). Although a list of Ohio's rare vascular plants was published 30 years ago (Jones, 1943), we here present a documented report on the imperiled species of aquatic vascular plants for Ohio, which to our knowledge is the first report for this group of plants for any given state. We are aware that reports of this type have certain limitations and will require revision as more information becomes available.

The indigenous or native aquatic vascular plants of Ohio are those plants that live and complete all or most of their life history in water or in a habitat that is wet throughout part of the year, such as a marsh, bog, or wet prairie. These plants generally grow submersed, floating, submersed with floating leaves, or emersed in shallow water. The inclusion of plants as aquatic and the information on their habitat comes from (1) available label data on herbarium specimens, (2) a knowledge of the biology of the species from our field studies in the state over the past eight years, and when necessary, (3) floristic literature for Ohio and adjacent states or from monographs of specific genera. Herbarium specimen records were obtained principally from the collections at The Ohio State University, Kent State University, The University of Cincinnati, and occasionally from Bowling Green State University and Miami University. Records for several groups studied by specialists (Ball for *Salix*, Mackenzie or Hermann for *Carex*, for exam-

ple) were extracted from the card files of E. Lucy Braun at The Ohio State University Herbarium. We sometimes had great difficulty characterizing the habitat of those species which have not been located in the state for fifty years or more.

Ohio's imperiled species of aquatic vascular plants can be grouped into four categories based principally on (1) their distribution and abundance geographically, (2) the changes in population numbers through time, (3) the abundance and quality of existing suitable habitats in the state, and (4) the peculiarities of the biology of the species. The following categories are established and defined for use in the annotated list presented in Table 1.

EXTINCT. An extinct species is one that has been completely eliminated not only from Ohio, but from all other areas of its range within historic time. None of Ohio's aquatic vascular plants belong in this category.

EXTIRPATED (EX). An extirpated species is one based on records known from one or more counties 70-80 years ago, but which has not been reported in Ohio since. These species may be expected to survive in areas nearby to Ohio. In some cases our knowledge of site conditions and the species tolerances leads us to believe they may not exist in Ohio despite relatively recent records. Forty species are considered to be extirpated in Ohio.

ENDANGERED (EN). An endangered species is one based on records known from one or more counties 70-80 years ago, but which has been recorded in Ohio from only one or two counties since 1950. These species are in immediate jeopardy in Ohio and could readily become extirpated through destruction or environmental changes of a few critical sites. A few species without recent records have been considered as endangered because we believe they are probably present in unstudied existing suitable sites. Fifty-four species are considered to be endangered in Ohio.

THREATENED (TH). A threatened species is one known from older records and has recently been recorded in Ohio from three to no more than seven counties since 1950. These species are believed to have continued to survive at population levels comparable to their previous abundance, but they could become endangered or extirpated if drastic environmental and habitat changes occur. Fifty-two species are placed in this category.

These 146 imperiled species of Ohio aquatic vascular plants, if not extirpated already, exist in such small population numbers that special attention should be given for their survival as a part of the state flora. We believe that the change in the number of populations through time illustrates the effects the environment has had on the survival of a species. The data for the species considered in Table 1 are presented to substantiate and explain their inclusion. The most appropriate time periods selected to show these changes in the number of populations for each species are (1) the number of counties with at least one population record before about 1900, (2) the number of counties with at least one population record since about 1950, (3) the year of the earliest known record, and (4) the year of the latest known record. A list of the counties where each species has been recorded

is also included (Table 1), and the number of imperiled species known for each county is stated in Table 2. The trends observed and recorded should be predictive if the data base is reasonably accurate and substantial, and if habitat destruction occurs at about the present pace. An alternative list of species tolerant of changes and increasing in population numbers could also be presented. Of the 146 imperiled species, eight have never been located in Ohio since 1900 and 30 additional ones have not been seen or reported in the past 25 years.

The habitats of Ohio's imperiled species of aquatic vascular plants are quite specialized and complex, such as bogs, fens, marshes, swamps and/or combinations of these with ponds, lakes, streams, and/or mudflats. In order to simplify and condense information on the habitat, we have listed one or two of the most characteristic kinds of habitats in which each one of these imperiled species may be expected to occur. The aquatic or wetland habitat types selected along with a note on their chief distinguishing feature are: pond or lake (quiet, open water), stream (flowing water), fen (calcareous substrate conditions), bog (acidic substrate conditions), marsh (dominated with herbaceous vegetation), swamp (dominated with woody vegetation), and mudflat (exposed soil conditions that were formerly covered with water earlier in the growing season).

Considerable changes in the aquatic vascular plant flora of particular sites (Stuckey, 1971; Judd & Taub, 1973; Lowden, 1969; Moore, 1973) and for the genus *Najas* (Wentz & Stuckey, 1971) have been documented in Ohio. Our data indicate that the aquatic habitats in northeastern Ohio and the marshes along the shoreline of Lake Erie in northwestern Ohio have the greatest diversity of aquatic vascular plants in the state. These areas also contain the largest number of imperiled species of aquatic vascular plants (Table 3). The glacial topography of northern Ohio contains most of the bog, fen, and lake flora of the state. The marsh, swamp, stream, and mudflat flora is as well or even more represented here as elsewhere. The northern portion of Ohio has been subjected to considerable agricultural development, including extensive drainage and channelization. The northeastern section is currently undergoing rapid urbanization with a severe impact on the bog, pond, and lake flora from residential and industrial development. This impact has been particularly significant in the Cleveland-Akron-Canton metropolitan areas in the counties of Portage, Summit, Stark, Lake, and Geauga. The counties bordering Lake Erie in northwestern Ohio (Erie, Lucas, and Ottawa) have been severely affected by shoreline development which has disturbed the flora of the marshes, swamps, and mudflats. It is fortunate that these areas of the state that are now currently most severely affected by habitat degradation were centers of field botanical research 70-80 years ago before such changes became apparent. The information available from the beginning of the century has, therefore, been invaluable for documenting the depletion of the aquatic vascular plant flora. These trends are clearly evident, and, therefore, we believe in a strong program

for further acquisition and protection of Ohio's aquatic vascular plants and their habitats in wetland sites.

Much of our field work on the aquatic vascular plant flora of Ohio has been supported by the Ohio Biological Survey during the seasons of 1967-1973. Thanks are also expressed to Mr. Thomas Duncan, Dr. Robert R. Haynes, Mr. Ronnie Johnson, and Mr. W. Alan Wentz, who have aided in our studies of the state's aquatic plant flora. Miss Edna Kirby contributed in assisting with obtaining data from the specimens in The Ohio State University Herbarium.

Table 1. Annotated Checklist of Imperiled Aquatic Vascular Plants Indigenous in Ohio.

Imperiled Status	Name of Plant and Habitat	Total Number of Counties			Year of Earliest Known Record	Year of Latest Known Record	List of Counties With Records‡
		Number of Counties With Records Before ca. 1900	Number of Counties With Records Since ca. 1950				
ISOETACEAE							
EX	<i>Isoetes braunii</i> Dur. Lake. Quillwort	1	0	0	1913	1935	67
EN	<i>Isoetes engelmannii</i> A. Br. Pond & Lake. Quillwort	4	1	1	1838	1973	11 [*] , 12 [†] , 50, 67
SPARGANIACEAE							
TH	<i>Sparganium androcladum</i> (Engelm.) Morong Marsh. Bur-reed	6	1	4	1894	1962	3, 8 [†] , 22 [*] , 50 [†] , 67 [†] , 77 [†]
EN	<i>Sparganium chlorocarpum</i> Rydb. Bog. Bur-reed	3	1	2	1892	1969	11 [†] , 25 [*] , 86 [†]
POTAMOGETONACEAE							
EN	<i>Potamogeton filiformis</i> Pers. Lake. Filiform Pondweed	1	0	1	1939	1970	62 [†]

‡ The numbers refer to the counties as listed in Table 2. An asterisk after the number indicates a record previous to 1900; a dagger after the number indicates a record since 1950.

EX	<i>Potamogeton friesii</i> Rupr. Lake. Pondweed	3	2	0	1895	1901	22*, 62*, 77
EN	<i>Potamogeton gramineus</i> L. Pond & Stream. Pondweed	6	4	2	1888	1970	22*, 26†, 48†, 62*, 73*, 85*
EX	<i>Potamogeton hillii</i> Morong Pond & Stream. Pondweed	2	1	0	1877	1913	4*, 67
EX	<i>Potamogeton perfoliatus</i> L. Lake. Pondweed	1	1	0	1898	1898	62*
EN	<i>Potamogeton praelongus</i> Wulfen. Lake. White-stem Pondweed	5	1	1	1898	1969	4, 22, 62*, 76, 86†
EN	<i>Potamogeton pulcher</i> Tuckerm. Pond. Spotted Pondweed	6	3	1	1838	1970	4, 11*, 12*, 25, 40†, 85*
EN	<i>Potamogeton richardsonii</i> (Ar. Benn.) Rydb. Lake. Red-head pondweed	8	5	2	1835	1970	4, 10†, 16*, 22*, 43, 62*†, 67*, 77*
EN	<i>Potamogeton robbinsii</i> Oakes Lake. Pondweed	3	2	2	1894	1966	22*, 67†, 77*†
TH	<i>Potamogeton spirillus</i> Tuckerm. Pond. Pondweed	6	2	4	189-	1971	4*, 28*, 47†, 50†, 67†, 78†
EX	<i>Potamogeton strictifolius</i> Ar. Benn. Lake. Pondweed	1	1	0	1895	1898	22*
EN	<i>Potamogeton tennesseensis</i> Fern. Pond & Stream. Pondweed	3	0	2	1932	1967	15†, 40, 82†
EX	<i>Potamogeton vaseyi</i> Robbins Lake. Pondweed	3	0	0	1900	1935	4, 67, 78
TH	<i>Potamogeton zosteri-</i> <i>formis</i> Fern. Lake. Flat-stem Pond- weed	10	6	4	1835	1970	11†, 22*, 28, 45*, 46*†, 62*†, 64*, 67†, 76*, 77
NAJADACEAE							
EX	<i>Najas gracillima</i> (A.Br.) Magnus Lake. Naiad	3	2	0	1898	1918	62*, 67, 85*
JUNCAGINACEAE							
TH	<i>Triglochin maritimum</i> L. Fen. Arrow-grass	6	4	3	1835	1972	11*†, 12*, 43, 46†, 76*†, 77*
TH	<i>Triglochin palustre</i> L. Fen. Arrow-grass	6	1	3	1840	1965	11†, 22*, 49, 71, 72†, 76†

EN *Scheuchzeria palustris* L. 7 3 1 1840 1973 3, 4, 23, 28*, 45*†, 47*,
Bog. 67

ALISMATACEAE

- TH *Echinodorus rostratus*
(Nutt.) Engelm. 4 0 2 1905 1973 31, 65†, 66†, 71
Mudflat. Bur-head
- TH *Sagittaria australis*
(J.G. Sm.) Small 10 3 6 1875 1972 1†, 6*, 7†, 12*, 13*,
Mudflat. Arrowhead 27†, 36†, 40†, 53, 66†
- EN *Sagittaria cuneata*
Sheldon 6 2 2 1894 1972 6, 22†, 40, 45, 62*†, 85*
- EX *Sagittaria graminea*
Michx. 4 2 1 1838 1951 11*, 18*, 48, 88†
Pond. Grass-leaf Arrow-
head
- TH *Sagittaria latifolia* Willd.
var. *pubescens* (Muhl.) 3 0 3 1961 1967 15†, 34†, 41†
J.G. Sm.
Marsh. Common Arrow-
head

GRAMINEAE

- TH *Calamagrostis inexpansa*
A. Gray 3 0 3 1946 1967 22†, 48†, 71†
Fen. Northern Reed
Grass
- EN *Glyceria acutiflora* Torr. 3 0 2 1842 1971 38†, 45, 59†
Swamp. Manna Grass
- EX *Glyceria borealis* (Nash)
Batchelder 1 0 0 1925 1925 48
Pond. Northern Manna
Grass
- TH *Glyceria grandis* S. Wats. 7 1 7 1842 1969 4†, 15†, 28†, 67†, 74†,
Bog. Tall Manna Grass 76*†, 85†
- TH *Glyceria melicaria*
(Michx.) F.T. Hubbard 9 4 4 1889 1961 4*, 18*, 23, 28†, 40,
Swamp. Manna Grass 43*, 67†, 77*†, 78†
- TH *Glyceria pallida* (Torr.)
Trin. 9 1 6 1840 1971 18†, 28†, 38†, 40†, 62,
Pond. Manna Grass 67†, 76*, 77†, 78†, 79
- EN *Zizania aquatica* L. 15 7 3 1833 1972 4, 12, 22*, 37*, 43, 45*,
Marsh. Annual Wild Rice 47, 48*, 57*, 62*†, 64*,
65†, 76, 77, 79†

CYPERACEAE

- EX *Carex alata* Torr. 5 5 0 1887 1899 18*, 43*, 76*, 77*, 85*
Bog & Marsh. Sedge
- EX *Carex aquatilis* Wahl. 7 7 0 1879 1939 6*, 22*, 43*, 46*, 47*,
Marsh. Sedge 48*, 62*

EN	<i>Carex atherodes</i> Spreng. Bog & Fen. Sedge	4	2	2	1897	1972	19 [†] , 22 [†] , 62 [†] , 85 [*]
EN	<i>Carex aurea</i> Nutt. Fen & Bog. Sedge	4	2	1	1898	1970	4 [*] , 22 [*] , 48, 77 [†]
EX	<i>Carex baileyi</i> Britt. Marsh. Sedge	1	0	0	1934	1934	40
EX	<i>Carex bebbii</i> (Bailey) Fern. Bog. Sedge	2	1	0	1893	1935	47 [*] , 76
EX	<i>Carex brunnescens</i> (Pers.) Poir. Bog & Swamp. Sedge	3	1	0	1871	1915	43 [*] , 45, 78
EX	<i>Carex cephalantha</i> (Bailey) Bickn. Bog. Sedge	5	3	0	1883	1913	28, 43 [°] , 47 [*] , 67 [*] , 76
EX	<i>Carex crus-corvi</i> Shuttlew. Fen. Sedge	5	4	0	1840	1935	6 [°] , 11 [*] , 20 [°] , 71, 87 [°]
TH	<i>Carex cryptolepis</i> Mack. Bog & Fen. Sedge	6	2	4	1871	1971	1 [†] , 4, 43 [*] , 48 [†] , 67 [†] , 76 ^{°†}
EX	<i>Carex decomposita</i> Muhl. Bog. Sedge	3	3	0	1838	1910	25 [°] , 31 [*] , 45 [*]
EX	<i>Carex diandra</i> Schrank Bog. Sedge	8	5	0	1840	1935	22 [*] , 25, 43 [*] , 45 [*] , 47 [*] , 67, 76, 77 [*]
EN	<i>Carex flava</i> L. Fen. Sedge	1	1	1	1840	1966	11 ^{°†}
EX	<i>Carex haydenii</i> Dew. Fen & Marsh. Sedge	4	2	0	1894	1922	22 [°] , 47 [°] , 67, 78
EN	<i>Carex howei</i> Mack. Bog. Sedge	10	5	1	1892	1958	28 [†] , 40, 43, 45 [*] , 47 [*] , 64, 67, 76 [°] , 77 [°] , 85 [°]
EN	<i>Carex interior</i> Bailey Fen & Bog. Sedge	8	3	2	1886	1960	15 [†] , 18 [†] , 22 [*] , 31, 40, 43 [*] , 47 [*] , 71
EX	<i>Carex lasiocarpa</i> Ehrh. Bog. Sedge	6	4	0	1889	1935	45 [°] , 47 [°] , 70, 76 [*] , 77 [*] , 85
EX	<i>Carex limosa</i> L. Bog. Sedge	5	2	0	1842	1945	3, 4 [*] , 23, 45, 85 [*]
EN	<i>Carex oligosperma</i> Michx. Bog. Sedge	2	1	1	1898	1968	20 [°] , 67 [†]
EX	<i>Carex projecta</i> Mack. Bog. Sedge	2	2	0	1894	1912	43 [*] , 47 [*]
EX	<i>Carex pseudo-cyperus</i> L. Bog. Sedge	2	2	0	1890	1922	22 [*] , 45 [*]
EX	<i>Carex retrorsa</i> Schwein. Marsh. Sedge	1	1	0	189-	189-	48 [*]
EX	<i>Carex sartwellii</i> Dew. Fen. Sedge	3	1	1	1893	1934	22 [*] , 48 [†] , 71
EN	<i>Carex sterilis</i> Willd. Fen. Sedge	4	2	1	1840	1965	11 ^{°†} , 22 [°] , 49, 76
EN	<i>Carex straminea</i> Willd. Marsh. Sedge	2	0	2	1935	1963	37 [†] , 40 [†]

EX	<i>Carex suberecta</i> (Olney) Britt. Marsh. Sedge	9	3	2	1898	1963	6*, 11*, 12†, 23, 25*, 29†, 31, 36, 71
EN	<i>Carex trisperma</i> Dew. Bog. Sedge	9	6	0	1871	1938	3, 4, 28*, 43*, 47*, 67*, 77*, 78, 86*
TH	<i>Carex viridula</i> Michx. Fen. Sedge	4	2	3	1893	1972	11*, 22*†, 62†, 77†
TH	<i>Cladium mariscoides</i> (Muhl.) Torr. Fen. Twig-Rush	6	2	4	1893	1969	11*†, 22*†, 28, 48†, 67, 88†
TH	<i>Cyperus diandrus</i> Torr. Mudflat. Umbrella Sedge	6	1	4	1898	1969	15†, 20*, 22†, 47, 48†, 62†
TH	<i>Cyperus engelmannii</i> Steud. Mudflat. Umbrella Sedge	9	3	6	1897	1971	4, 6*†, 22†, 45†, 46*†, 48†, 62†, 76, 85*
TH	<i>Eleocharis compressa</i> Sulliv. Fen. Flat-stemmed Spike- rush	10	5	7	1840	1969	1†, 22*†, 26*, 43*, 48†, 49*, 51†, 62*†, 67†, 71, 76†
TH	<i>Eleocharis elliptica</i> Kunth Fen. Spike-rush	7	3	4	1892	1969	7, 22*†, 47*, 48*†, 62†, 66, 87†
TH	<i>Eleocharis intermedia</i> Schultes Mud-flat. Matted Spike- rush	9	2	7	1840	1974	15†, 20†, 23, 25*, 29†, 45†, 48†, 62*†, 86†
EN	<i>Eleocharis olivacea</i> Torr. Bog & Mudflat. Olivaceous Spike-rush	5	2	3	1894	1970	11†, 18*, 62†, 77*, 86†
EN	<i>Eleocharis pauciflora</i> (Lightf.) Link Fen. Spike-rush	3	0	1	1929	1967	11, 71, 86†
TH	<i>Eleocharis quadrangulata</i> (Michx.) R. & S. Marsh. Four-angled Spike-rush	7	1	4	1891	1973	1†, 3, 8†, 40†, 44†, 67, 77*
TH	<i>Eleocharis rostellata</i> Torr. Fen. Spike-rush	9	2	8	1892	1973	11*†, 15†, 22*, 38†, 46*†, 55, 67†, 76†, 77†
TH	<i>Eriophorum virginicum</i> L. Bog. Tawny Cotton-grass	11	7	3	1887	1973	3, 4*, 20*, 28*, 39, 45*†, 47*, 67*†, 70, 76†, 85*
TH	<i>Eriophorum viridi-cari- natum</i> (Engelm.) Fern. Bog. Cotton-grass, Bog- cotton	10	5	5	1884	1969	4, 11†, 18*†, 22*, 28†, 43*, 45*, 67†, 76, 77*†
EN	<i>Hemicarpha micrantha</i> (Vahl) Pax Mudflat.	5	0	2	1928	1967	4, 40, 48†, 65, 86†
TH	<i>Rhynchospora alba</i> (L.) Vahl Fen. White Beak-rush	14	7	4	1840	1971	4, 11*†, 22*, 28*, 38†, 39, 40, 45*, 47*, 67†, 70, 76, 77*†, 85*

EX	<i>Rhynchospora globularis</i> (Chapm.) Small Fen. Beak-rush	3	1	0	1897	1946	22*, 48, 71
EN	<i>Scirpus expansus</i> Fern. Marsh. Bulrush	5	2	2	1898	1973	38†, 42†, 62*, 70*, 85
TH	<i>Scirpus pedicellatus</i> Fern. Bog. Bulrush	9	2	3	1887	1954	6*, 18, 43*, 47, 51†, 65†, 77†, 78, 85
TH	<i>Scirpus purshianus</i> Fern. Mudflat. Bulrush	8	3	3	1885	1973	14†, 40†, 43*, 62*, 65, 66, 77*, 82†
EN	<i>Scirpus smithii</i> Gray Mudflat. Bulrush	1	1	1	1895	1970	62*†
EX	<i>Scirpus torreyi</i> Olney Marsh. Bulrush	3	3	0	1889	1896	22*, 43*, 62*
EN	<i>Scleria pauciflora</i> Willd. Fen. Nut-rush	6	1	1	1897	1960	1†, 22*, 40, 48, 66, 71
TH	<i>Scleria verticillata</i> Willd. Fen. Nut-rush	9	3	5	1840	1969	11*†, 12, 22*†, 24, 25*, 29†, 65, 67†, 71†
ARACEAE							
TH	<i>Calla palustris</i> L. Bog. Wild Calla	8	6	5	1837	1971	4*†, 18†, 28†, 39*, 67*†, 76*†, 77*, 78*
LEMNACEAE							
EN	<i>Lemna valdiviana</i> Phillipi Pond. Pale Duckweed	2	0	1	1901	1958	13†, 43
TH	<i>Wolffia papulifera</i> C.H. Thompson Pond. Pointed Wolffia	4	0	3	1932	1973	40, 47†, 67†, 83†
EX	<i>Wolffiella floridana</i> (J.D. Sm.) C.H. Thompson Pond. Star Wolffiella	5	0	0	1906	1930	23, 45, 64, 67, 77
XYRIDACEAE							
EX	<i>Xyris difformis</i> Chapman Bog. Yellow-eyed-Grass	2	2	0	1890	1891	28*, 67*
EN	<i>Xyris torta</i> Sm. Mudflat. Yellow-eyed- Grass	5	1	2	1892	1961	27†, 40, 48†, 73, 87*
ERIOCAULACEAE							
EX	<i>Eriocaulon septangulare</i> With. Mudflat. White-buttons, Duckgrass	2	0	0	1913	1915	67, 77
PONTEDERIACEAE							
EX	<i>Heteranthera reniformis</i> R. & P. Mudflat. Mud-plantain	2	2	0	1837	1849	31*, 57*
JUNCACEAE							
TH	<i>Juncus alpinus</i> Vill. Fen. Rush	5	3	2	1840	1972	18*, 22†, 43*, 48, 62*†

EN	<i>Juncus greenei</i> Oakes & Tuckerm.	1	0	1	1927	1971	48†
	Mudflat. Rush						
EN	<i>Juncus interior</i> Wieg.	2	0	1	1933	1966	49, 72†
	Marsh. Rush						
TH	<i>Juncus subcaudatus</i> (Engelm.) Coville & Blake	3	0	3	1950	1967	37†, 65†, 71†
	Marsh. Rush						
LILIACEAE							
TH	<i>Tofieldia glutinosa</i> (Michx.) Pers.	8	4	5	1835	1973	11*†, 12*, 46†, 48, 57*, 67†, 76*†, 77†
	Fen. False Asphodel						
IRIDACEAE							
TH	<i>Iris brevicaulis</i> Raf.	13	2	3	1837	1965	6*, 19†, 25, 31*, 35, 36, 51, 62, 65, 71, 80, 81†, 83†
	Marsh. Leafy Blue Flag						
ORCHIDACEAE							
EN	<i>Arethusa bulbosa</i> L.	3	3	2	1891	1960	45*†, 47*, 67*†
	Bog. <i>Arethusa</i> ; Dragon's mouth						
EN	<i>Cypripedium candidum</i> Willd.	8	4	2	1836	1968	11*, 12*, 22*†, 48, 57*, 67†, 78, 88
	Fen. White Lady's-slipper						
EX	<i>Habenaria blephariglottis</i> (Willd.) Hook.	5	3	0	1835	1937	4*, 28, 48, 67*, 77*
	Bog. White Fringed Orchid						
EX	<i>Habenaria ciliaris</i> (L.) R.Br.	6	2	0	1893	1944	1, 26*, 43, 48*, 71, 73
	Bog. Orange or Yellow Fringed Orchid						
EX	<i>Habenaria leucophaea</i> (Nutt.) A. Gray	5	4	0	1838	1916	6*, 11*, 22, 25*, 57*
	Bog. Prairie White Fringed Orchid						
TH	<i>Spiranthes lucida</i> (H.H. Eat.) Ames	13	6	3	1887	1961	1†, 11, 13*, 18*, 29*, 43*, 48, 52*, 66, 67*, 71†, 77†, 78
	Fen & Marsh. Shining Ladies' Tresses						
EN	<i>Spiranthes romanzoffiana</i> Cham.	6	4	2	1882	1960	4*†, 22*, 28, 43*, 52*, 76†
	Fen. Hooded Ladies' Tresses						
SALICACEAE							
TH	<i>Salix bebbiana</i> Sarg.	12	10	1	1892	1974	4*, 22*, 26*, 35†, 39, 43*, 47*, 48*, 62*, 77*, 87*, 88*
	Bog & Fen. Long-beaked Willow						
TH	<i>Salix candida</i> Fluegge	8	4	4	1898	1967	15†, 22*†, 26*, 67†, 76*, 77, 86†, 88*
	Bog & Fen. Sage-leaf Willow						

TH	<i>Salix pedicellaris</i> Pursh Bog & Fen. Bog Willow	12	5	2	1891	1969	3, 4, 11, 28 [†] , 39, 45*, 64*, 67*, 76, 77 [†] , 85*, 86*
TH	<i>Salix petiolaris</i> J.E. Smith Bog & Fen. Willow	8	5	3	1879	1969	6*, 15 [†] , 22*, 26*, 48*, 67 [†] , 77 [†] , 86, 87*
TH	<i>Salix serissima</i> (Bailey) Fern. Bog & Fen. Autumn Willow	5	1	4	1899	1969	15 [†] , 67 [†] , 76 [†] , 77 [†] , 86*
EN	× <i>Salix subsericea</i> (An- derss.) Schneid. Bog & Fen. Willow.	4	3	1	1899	1969	4*, 11*, 47*, 77 [†]
MYRICACEAE							
EN	<i>Myrica pensylvanica</i> Loisel. Bog. Bayberry	3	1	1	189-	1961	4, 67 [†] , 77*
BETULACEAE							
TH	<i>Betula pumila</i> L. Fen. Low Birch	7	4	3	1835	1972	11* [†] , 12, 67, 76*, 77*, 86 [†] , 88* [†]
URTICACEAE							
TH	<i>Pilea fontana</i> (Lunell) Rydb. Marsh. Clearweed	7	0	7	1900	1974	15 [†] , 42 [†] , 67 [†] , 72 [†] , 76 [†] , 79 [†] , 86 [†]
POLYGONACEAE							
EN	<i>Polygonum pensylvani- cum</i> L. var. <i>eglandu- losum</i> Myers Mudflat. Smartweed	2	0	2	1940	1975	22 [†] , 62 [†]
CERATOPHYLLACEAE							
TH	<i>Ceratophyllum echinatum</i> Gray Pond. Hornwort, Coontail	9	0	5	1913	1974	4 [†] , 10 [†] , 25, 39 [†] , 40, 47 [†] , 62 [†] , 67, 70
NYMPHAEACEAE							
EN	<i>Nuphar variegatum</i> Engelm. Pond. Yellow Water-lily, Spatter-dock	3	1	2	1894	1970	22*, 48 [†] , 62 [†]
RANUNCULACEAE							
EN	<i>Ranunculus pusillus</i> Poir. Marsh & Mudflat. Water Crowfoot	4	0	1	1922	1950	4, 13, 27 [†] , 71
CRUCIFERAE							
EX	<i>Armoracia aquatica</i> (Eat.) Wieg. Stream. Lake Cress	6	4	0	1889	1936	16*, 45*, 48, 49*, 64*, 65

TH	<i>Rorippa sessiliflora</i> (Nutt.) Hitchc. Mudflat. Yellow-cress	7	1	4	1878	1970	1†, 31*, 54†, 62†, 65†, 66, 71
SARRACINEACEAE							
TH	<i>Sarracenia purpurea</i> L. Bog. Pitcher-plant	14	9	4	1835	1971	3, 4*, 20*, 28*†, 39, 45†, 46*, 47*, 67†, 70, 76*†, 77*, 85*, 86*
DROSERACEAE							
EN	<i>Drosera intermedia</i> Hayne Bog. Sundew	4	1	1	1899	1967	28†, 43, 48, 85*
ROSACEAE							
TH	<i>Potentilla palustris</i> (L.) Scop. Bog. Marsh Cinquefoil	14	8	3	1838	1960	3, 4*, 11*, 18†, 28†, 38, 39, 45*, 47*, 67*, 76*†, 77*, 78, 85*
CALLITRICHACEAE							
TH	<i>Callitriche terrestris</i> Raf. emend Torr. Mudflat. Water Starwort	10	1	3	1890	1969	13*, 21, 25, 31, 37, 41†, 60, 67†, 71, 83†
TH	<i>Callitriche verna</i> L. Pond & Stream. Starwort	7	3	2	1888	1971	4, 10†, 18*, 25, 28*, 47*, 78†
RHAMNACEAE							
TH	<i>Rhamnus alnifolia</i> L'Her. Fen. Buckthorn	10	3	7	1840	1972	4†, 11*†, 15†, 18*, 28, 43*, 48†, 67†, 76†, 77†
HYPERICACEAE							
TH	<i>Hypericum kalmianum</i> L. Fen. St. John's-wort	6	4	3	1891	1960	22*†, 26†, 48*, 62*, 76†, 77*
HALORAGACEAE							
EN	<i>Myriophyllum exalbes-</i> <i>cens</i> Fern. Pond & Lake. Water- milfoil	12	10	4	1891	1972	6*, 18*, 22*, 23*, 38†, 45*, 46*, 62*†, 64*, 67*†, 76†, 86*
EN	<i>Myriophyllum hetero-</i> <i>phyllum</i> Michx. Pond & Stream. Water- milfoil	7	1	2	1835	1973	4, 11, 36, 45*, 46†, 78, 80†
EX	<i>Myriophyllum verticil-</i> <i>latum</i> L. Lake. Water-milfoil	2	2	0	1838	1840	11*, 67*
UMBELLIFERAE							
TH	<i>Hydrocotyle americana</i> L. Swamp. Water-pennywort	12	6	6	1885	1971	15†, 18*, 28†, 38†, 43*, 45†, 67†, 71, 76*†, 77*, 79*, 85*
EN	<i>Hydrocotyle umbellata</i> L. Pond. Water-pennywort	4	2	2	1891	1971	4, 28†, 67*†, 76*

ERICACEAE

EX	<i>Andromeda glaucophylla</i> Link Bog. Bog-rosemary	5	2	0	1878	1929	4, 28*, 76, 77, 85*
TH	<i>Chamaedaphne calyculata</i> (L.) Moench Bog. Leather-leaf	11	6	4	1871	1970	4, 18†, 20*, 22, 28*†, 45, 67†, 76*†, 77*, 85*, 86*
EN	<i>Vaccinium oxycoccos</i> L. Bog. Small cranberry	8	4	2	1889	1961	3, 28†, 45*, 47*, 67†, 76, 77*, 85*

PRIMULACEAE

EN	<i>Hottonia inflata</i> Ell. Pond. Featherfoil	2	1	1	1891	1974	4*, 73†
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GENTIANACEAE

EN	<i>Menyanthes trifoliata</i> L. Bog. Buckbean	12	5	1	1835	1970	3, 4, 11*, 25, 28, 39, 43*, 45*†, 67, 76, 77*, 85*
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SCROPHULARIACEAE

EN	<i>Gratiola virginiana</i> L. Mudflat. Hedge-hyssop	4	1	2	1897	1973	13, 22*, 27†, 40†
EN	<i>Gratiola viscidula</i> Pennell Mudflat. Hedge-hyssop	3	0	3	1932	1974	27†, 40†, 73†

LENTIBULARIACEAE

EN	<i>Utricularia cornuta</i> Michx. Fen & Bog. Bladderwort	3	3	1	1839	1964	11*†, 77*, 85*
EN	<i>Utricularia intermedia</i> Hayne Fen & Bog. Bladderwort	5	2	3	1893	1972	11†, 43*, 67†, 76†, 85*
EN	<i>Utricularia minor</i> L. Fen & Bog. Bladderwort	4	1	2	1893	1972	11*†, 15†, 45, 67

PLANTAGINACEAE

EN	<i>Plantago cordata</i> Lam. Stream. Plantain	7	3	1	1835	1973	1†, 6*, 25*, 46, 47*, 48, 49
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CAPRIFOLIACEAE

EX	<i>Linnaea borealis</i> Gronov. Bog. Twinflower	2	1	0	1900	1924	76*, 77
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VALERIANACEAE

EN	<i>Valeriana ciliata</i> Torr. & Gray Fen. Valerian	1	1	1	1837	1964	11*†
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COMPOSITAE

EX	<i>Megalodonta beckii</i> (Torr.) Greene Lake. Bur-marigold	7	5	1	1860	1966	4, 22*, 52*, 62*, 67†, 76*, 77*
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Table 2. Numbered List of Ohio Counties With Numbers of Imperiled Species in Each County.

Number	County	Number of Imperiled Species		County	Number of Imperiled Species
		Species	Number		
1	Adams	8	45	Licking	27
2	Allen	0	46	Logan	10
3	Ashland	9	47	Lorain	27
4	Ashtabula	37	48	Lucas	33
5	Athens	0	49	Madison	5
6	Auglaize	12	50	Mahoning	3
7	Belmont	2	51	Marion	3
8	Brown	2	52	Medina	3
9	Butler	0	53	Meigs	1
10	Carroll	2	54	Mercer	0
11	Champaign	35	55	Miami	1
12	Clark	10	56	Monroe	0
13	Clermont	5	57	Montgomery	5
14	Clinton	1	58	Morgan	1
15	Columbiana	14	59	Morrow	1
16	Coshocton	1	60	Muskingum	0
17	Crawford	0	61	Noble	0
18	Cuyahoga	17	62	Ottawa	31
19	Darke	2	63	Paulding	0
20	Defiance	6	64	Perry	6
21	Delaware	1	65	Pickaway	8
22	Erie	47	66	Pike	6
23	Fairfield	7	67	Portage	60
24	Fayette	1	68	Preble	0
25	Franklin	14	69	Putnam	0
26	Fulton	7	70	Richland	5
27	Gallia	4	71	Ross	17
28	Geauga	28	72	Sandusky	3
29	Greene	4	73	Scioto	4
30	Guernsey	0	74	Seneca	1
31	Hamilton	6	75	Shelby	0
32	Hancock	0	76	Stark	43
33	Hardin	0	77	Summit	49
34	Harrison	1	78	Trumbull	14
35	Henry	2	79	Tuscarawas	4
36	Highland	4	80	Union	2
37	Hocking	4	81	Van Wert	1
38	Holmes	8	82	Vinton	2
39	Huron	8	83	Warren	3
40	Jackson	20	84	Washington	0
41	Jefferson	2	85	Wayne	25
42	Knox	2	86	Williams	15
43	Lake	30	87	Wood	5
44	Lawrence	0	88	Wyandot	6

Table 3. Counties with the Largest Numbers of Imperiled Species.

Rank	County	Number of Imperiled Species	Portion of the State
1	Portage	60	Northeastern
2	Summit	49	Northeastern
3	Erie	47	Northwestern
4	Stark	43	Northeastern
5	Ashtabula	37	Northeastern
6	Champaign	35	West-central
7	Lucas	33	Northwestern
8	Ottawa	31	Northwestern
9	Lake	30	Northeastern
10	Geauga	28	Northeastern
11	Licking	27	Central
12	Lorain	27	Northeastern

APPENDIX

Those species of very limited occurrence in the state which we consider as non-indigenous (non-native) to the flora of Ohio are enumerated in part 1 of the appendix. In certain situations, our concepts of which species are non-indigenous differ somewhat with previously published statements, hence the need for this separate list. For those individuals who consider some of these species in this list as indigenous (native), they would have to be placed in table 1. In part 2 of the appendix, we list all of those species known to us which have been reported for Ohio as having a very limited occurrence in the state, but which have been eliminated from consideration because of the reasons that are stated for each species.

Appendix Part 1. Annotated List of Rare Aquatic Plants
Non-Indigenous in Ohio.

Name of Plant and Habitat	Total Number of Counties	Number of Counties with Records Before ca. 1900	Number of Counties with Records Since ca. 1950	Year of Earliest Known Record	Year of Latest Known Record	List of Counties With Records [†]
MARSILEACEAE						
Marsilea quadrifolia L. Pond. Water Clover	2	0	1	1941	1970	23 [†] , 25

SALVINIACEAE

Azolla caroliniana Willd. 9 2 5 1901 1974 22†, 25, 31, 43*, 48*†, 62†, 67, 76†, 79†
Pond. Water-velvet

NAJADACEAE

Najas marina L. 2 0 2 1949 1971 22†, 62†
Pond. Naiad

GRAMINEAE

Calamagrostis cinnoides
(Muhl.) Bart. 1 1 0 18— 18— 45*
Marsh. Reed Bentgrass

CYPERACEAE

Eleocharis caribaea (Rottb.)
S.F. Blake 1 0 1 1967 1970 62†
Mudflat. Spike-rush

Eleocharis wolffii Gray 1 0 0 1945 1945 71
Fen. Spike-rush

Eriophorum gracile W.D.J.
Koch 1 0 0 1931 1931 25
Bog. Cotton-grass

Scirpus saximontanus Fern. 1 0 1 1936 1973 65†
Mudflat. Bulrush

JUNCACEAE

Juncus diffusissimus Buckl. 4 0 4 1954 1972 40†, 44†, 66†, 73†
Marsh. Rush

NYMPHAEACEAE

Cabomba caroliniana Gray 3 0 2 1933 1971 43, 77†, 78†
Stream. Fanwort

ELATINACEAE

Elatine brachysperma Gray 1 0 1 1935 1935 65†
Mudflat. Waterwort

LYTHRACEAE

Lythrum hyssopifolia L. 1 0 1 1935 1955 65†
Mudflat. Loosestrife

ONAGRACEAE

Ludwigia decurrens Walt. 4 0 4 1951 1974 1†, 8†, 27†, 44†
(*Jussiaea decurrens*
(Walt.) DC.)
Mudflat. Primrose-willow

Ludwigia leptocarpa (Nutt.)
Hara 2 0 2 1951 1973 1†, 8†
(*Jussiaea leptocarpa* Nutt.)
Mudflat. Primrose-willow

HALORAGACEAE

Myriophyllum aquaticum
(Vellozo) Verdc. 1 0 1 1949 1959 73†

(*M. brasiliense* Cambess.)
Pond & Stream. Parrot's
Feather

UMBELLIFERAE

Hydrocotyle ranunculoides
L.f. 2 0 2 1959 1971 10[†], 38[†]
Marsh. Water-pennywort

PRIMULACEAE

Centunculus minimus L. 2 0 0 1935 1935 40, 65
Mudflat. Chaffweed

MENYANTHACEAE

Nymphoides peltatum
(Gmel.) Ktze. 1 0 0 1930 1930 4
Stream. Floating-heart

COMPOSITAE

Senecio glabellus Poir. 2 0 1 1926 1974 62[†], 68
Mudflat. Butterwort

Appendix Part 2. Species Excluded

Species	Locality	Reference	Reason for Exclusion
<i>Hippuris vulgaris</i> L.	Ohio	Muenschler (1944)	No specimen located
<i>Lemna minima</i> Phillipi	Paulding County	Hicks (1937), Braun (1967)	No specimen located
	Cuyahoga County	Walters (1950)	No specimen located
	Ohio	Muenschler (1944)	No specimen located
<i>Lemna perpusilla</i> Torr.	Mercer County	Hicks (1937)	Mercer County specimen not located; Knox County specimen is <i>L. minor</i>
	Knox and Mercer Counties	Braun (1967)	
<i>Mayaca aubleti</i> Michx.	Auglaize County	Gleason (1905)	Erroneously reported according to Gleason (1952, Vol. 1, p. 377)
	Ohio	Muenschler (1944)	No specimen located
<i>Myriophyllum alterniflorum</i> DC.	Ohio	Muenschler (1944)	No specimen located
<i>Myriophyllum humile</i> (Raf.) Morong	Ohio	Muenschler (1944)	No specimen located
<i>Peplis diandra</i> Nutt. (<i>Didiplis</i>)	Lake County	Schaffner (1932), Jones (1943),	Specimen is <i>Callitriche</i>

diandra (Nutt.) Wood)		Blackwell (1970)	<i>heterophylla</i>
Podostemum ceratophyllum Michx.	Pickaway County	Althaus (1967)	Specimen is <i>Riccia fluitans</i>

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